

APPENDIX A: Diversion and Release Schedule for Preliminary Delta Wetlands DSM2 Study

Jones and Stokes consultants originally created the preliminary diversion and release schedule for the Delta Wetlands project islands: Bacon Island and Webb Tract. This schedule lumped the total storage, diversions, and releases for both islands into one value per time step. A sample of these original values is shown as the gray columns in Figure A1 below.

DSM2 required that the flows into and out of the project islands be divided. Although the Jones and Stokes data included combined diversions and exports (releases), these flows did not balance the combined target storage for the two islands in many of the time steps. It is likely that this difference was due to the modeling of some sink term such as evaporation in the Jones and Stokes study. DSM2 does not account for evaporation or channel losses, thus it was decided that the combined target storage amounts would be used to build a new schedule, see Figure A1.

Water Month Year		Delta			<1>	<2>	<3>	<4>		<5>	<6>	<7>	<8>	<9>	<10>	<11>	<12>	<13>	<14>	<15>
		Delta Storage (TAF)	Storage Diversion (cfs)	Storage Export (cfs)	Change in Storage (TAF)	Target Storage (TAF)	Storage Webb (TAF)	Target Max Bacon (cfs)	Flows Max Webb (cfs)	Change in Storage (TAF)	Storage Webb (TAF)	Required Flows Bacon (cfs)	Flows Webb (cfs)	Excess After Bacon (cfs)	Flows Webb (cfs)	Releases Bacon (cfs)	Flows Webb (cfs)	DSM2 Flows Bacon (cfs)	Flows Webb (cfs)	
87	OCT	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	NOV	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	DEC	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	JAN	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	FEB	30	45	806	0	45	45	0	746	0	45	0	746	0	60	60	0	0	373	0
	MAR	30	43	25	0	-2	0	43	0	713	-45	43	-746	713	771	58	0	0	0	356
	APR	30	39	0	0	-4	0	39	0	646	0	-4	0	-66	0	66	0	0	0	0
	MAY	30	33	0	0	-6	0	33	0	547	0	-6	0	-99	0	99	0	0	0	0
	JUN	30	0	0	432	-33	0	0	0	0	0	-33	0	-547	0	115	0	432	0	0
88	JUL	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	AUG	30	4	60	0	4	4	0	66	0	4	0	66	0	-6	-6	0	0	33	0
	SEP	30	0	0	0	-4	0	0	0	0	-4	0	-66	0	66	66	0	0	0	0
	OCT	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	NOV	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	DEC	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	JAN	30	184	2,999	0	184	120	64	1989	1061	120	64	1989	1061	1010	-51	0	0	995	530
	FEB	30	68	0	2,000	-116	0	68	0	1127	-120	4	-1989	66	1989	-77	1989	11	0	33
	MAR	30	0	0	1,052	-68	0	0	0	0	0	-68	0	-1127	0	75	0	1,052	0	0
	APR	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	MAY	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	JUN	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	JUL	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	AUG	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	SEP	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure A1: Spreadsheet used to calculate DSM2 diversion and release schedules.

A set of operating rules was described in Table 2 of the *Delta Wetlands Preliminary DSM2 Studies* report. Essentially this set of rules can be described as a “first on, first off” process. This type of operating rule requires keeping track of net changes in storage. Since the combined delta storage was considered fixed, changes in storage (in TAF) were calculated for each time step for column <1>. When the net change was increasing, operating rule 1 (fill Bacon to 120 TAF) was applied. When the net change was decreasing, operating rule 2 (use Bacon first –or– keep Webb at 118 TAF) was applied.

The target storage for each island was divided based on which operating rule was being applied (as determined from <1>). The following logic was used to determine exactly how much water should be stored in Bacon Island for column <2>. If the net change calculated in <1> is positive, then the islands are filling. If the combined Delta storage is less than 120 TAF (the capacity of Bacon Island), then fill Bacon to that amount.

Otherwise, the combined storage is above 120 TAF, so both islands should be filled. Bacon will be filled to capacity, and the excess water should be placed in Webb Tract. If the net change calculated in <1> is negative, then the islands are releasing. If the combined Delta storage is less than 118 TAF (the capacity of Webb Tract), then Bacon should be completely empty and the remaining difference should come from Webb Tract. Otherwise, the storage is above 118 TAF, so the releases will only need to come from Bacon Island.

Using the combined Delta Storage given by Jones and Stokes and the target storage amount for Bacon Island <2>, the difference between the two is the target storage for Webb Tract <3>.

DSM2 uses flow rates instead of storage volumes, so each planning month storage was converted from TAF into cfs using Formula A1. A planning month of 30 days was assumed for this calculation.

$$Flow = \frac{Storage \times 1000}{days\ in\ month \times 1.9834} \quad [Eqn. A1]$$

The flows that would be required to completely fill Bacon Island <4> and Webb Tract <5> if each were empty were calculated using Equation A1.

The change in Bacon Island <6> and Webb Tract <7> storage of the current month from the previous month was calculated for each island. These storage amounts represent the actual required flows for each island. Equation A1 was used again to convert the total required Bacon Island diversion <8> and total required Webb Tract diversion <9>.

The original Jones and Stokes study did provide estimates of diversions and releases into the combined island system. The excess flow based on storage requirements between this given value and the required Bacon Island diversions was calculated in column <10>. By doing this, Bacon Island should exactly meet the storage requirements as determined by the Jones and Stokes operating rules and there would be no accumulation or loss in water mass over the period of study.

The excess flow calculated in <10> was then used to fill Webb Tract, however the excess water that is not accounted for in DSM2 needed to be accounted for. The difference between the required Webb Tract diversion and this flow excess was calculated in <11> and labeled as the Excess flow after Webb Tract diversion. This difference was then converted into a time series and treated as a mass balance correction time series (it would act either as a source or sink term applied directly to Webb Tract in order to prevent the island from overflowing over the period of the study).

The releases from Bacon Island <12> were also calculated based on changes in total storage. Again, applying the logic of the Jones and Stokes operating rules (see Table 2), the following logic was used to create DSM2 release schedules. When there is a release in the original study (i.e. a positive delta storage export), then the change in storage for

Bacon Island, column <6> was multiplied by -1 and converted into flows using Equation A1. The releases from Webb Tract <13> were calculated as the difference between the Bacon Island releases and the Jones and Stokes scheduled releases. NOTE: Changes in the storage of Webb Tract were not used, because the diversions into Webb Tract were based on flow differences and not target storage amounts. Since a source / sink term was added to account for the differences between inflow and target storage, the same accounting technique needed to be used to remove water from Webb Tract.

The inflows for each islands' intakes were taken to be $\frac{1}{2}$ of each islands required inflow. For example, Bacon Island's intake inflows <14> were simply $\frac{1}{2}$ of the Bacon Island required diversion <8>; and Webb Tract's intake inflows <16> were $\frac{1}{2}$ of the Webb Tract required diversion <9>.